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III.—*On the Seiches of Lakes.* By Colonel J. R. Jackson, F.R.G.S., St. Petersburgh.

The Lake Leman, or of Geneva, has been long remarkable for a phenomenon, known by the name of *seiches,* and which has been considered peculiar to this lake: it consists of a kind of ebb and flow of the waters of the lake, in certain parts, without wind or any other apparent cause. While the phenomenon lasts, the waters are seen to rise and fall several times in the course of a few hours. These oscillations, more or less considerable, sometimes attain the height of five feet, though the general maximum seldom exceeds two feet: in the greater number of cases the rise is confined to a few inches, the minimum being 0.

The *seiches* of the Lake of Geneva were observed, in the beginning of the last century, by Fatio de Duilliers, who has given a description of them in a Memoire inserted in the second volume of Spore's "Histoire de Geneve." Shortly after, Professor Jallabert made mention of them in the "Mémoires de l'Académie des Sciences." And, more lately, Mr. Serre, in the "Journal des Savans;" Professor Bertrand, in an academical dissertation, not printed; as also, Desaussure, in the first volume of his "Voyage aux Alpes," have successively described this singular phenomenon.

Nothing, however, having been explained in a sufficiently satisfactory manner, I wrote, some months since, to a learned professor of Geneva, on the subject,—proposing questions, the answers to which I hoped might throw some light on the nature of a fact which I apprehended to be by no means peculiar to the Lake of Geneva; and I have reason to congratulate myself, that the result of this step has been the publication of an able and detailed memoir on the subject by Professor Vaucher, which memoir had been written many years before, and which, in all probability, would never have been printed but at the instigation of Professor Maurice, to whom I had written, and who, with that readiness which distinguishes the real lover of science, interested himself immediately in the subject.

From Professor Vaucher's memoir, a quarto of sixty pages, written in French, so far back as the years 1803-4, it appears,—

1st. That the seiches of the Lake of Geneva are much more frequent than is generally imagined.

2dly. That they happen indifferently at all seasons of the year, and at all hours of the day; but that they are, generally speaking, most frequent in the spring and in the autumn.

3dly. That the state of the atmosphere seems to have a decided influence, it being remarked, that in proportion as that state is less changeable, so are the seiches less frequent, and *vice versâ*. The seiches have always been "*considérable*" (query—as to frequency or magnitude?) when the atmosphere has been loaded with heavy clouds, or when the weather, in other respects serene, has threatened to be stormy, and when the barometer has sunk.

4thly. That although the seiches are more frequent in the spring and in the autumn, they are however more "*considérables*" (rise higher) in the summer, and in particular towards the close of that season. The highest that have been observed happened in the month of September.

5thly. The minimum of the seiches has no precise term; their maximum seems to be five feet.

6thly. That although the duration of the seiches is very variable, its greatest extent seems not to exceed twenty or twenty-five minutes, but usually lasts a much shorter time.

7thly. That the seiches are not peculiar to the Lake of Geneva, M. Vaucher having observed them on the Lakes of Zurich, of Annecy, and of Constance.

It appears unquestionable, that the phenomenon of the seiches is due to an unequal pressure of the atmosphere on different parts of the lake at the same time; that is, to the simultaneous effect of columns of air of different weight or different elasticity, arising from temporary variations of temperature or from mechanical causes; and if such be in fact the case, all lakes of a certain extent, and even inland seas, must be subject to the same influence, and therefore present the same phenomenon; and I have little doubt but that correct observations will verify this presumption.

Moreover, the effect of unequal atmospheric pressure, in producing inequality in the level of the surface of large masses of water, once established as a positive fact, will throw much light upon several subjects interesting to physical geography, particularly upon that of currents, as affected by sea and land breezes, irregular winds, sudden changes of temperature, the configuration and aspect of coasts as regards the sun; and the consequent periodical influence of reverberated heat on the density of the circumjacent air.

It is, therefore, upon these considerations that I am desirous of calling to the subject the attention of such persons, as from the habitual nature of their occupations, or their studies, or their love of science, are best enabled to add to our knowledge regarding it. And in the hopes that some of the members of our society, or that, at their instigation, others, who may be in the vicinity of lakes in any part of the world, will take up the subject, I shall venture to offer what I conceive to be the best method of operating.

1st. Several points must be chosen on the lake, some in its narrower and some in its wider parts, as well as at the mouth of its most considerable *affluent*, and at the immediate egress of its main outlet. If the surface of the lake be observed to incline towards the outlet from any distance, a station should be established at the commencement of this slope as well as at the immediate egress.

2dly. These points once chosen, a squared pole must be driven, having marked upon it, in white upon a black, or in black upon a white ground, feet, inches, and lines, for at least five feet above and as many below the general water level. To this pole must be added a float, surmounted by a rod to act as an indicator, which rod must slide easily in brackets fastened to the pole. Round the pole, and rising above the water, an inclosure of about two or three feet diameter must be established, of hurdles or planks, in such wise, that, while the water within has free communication with that which is without the inclosure, so as to rise and fall with it, the former may be kept calm and secured from all influence of winds and waves.

3dly. These stations being established, two observers, at least, and more if possible, must commence their observations at an hour agreed upon, having first compared their watches. If *each* observer could at the same time be furnished with a barometer, thermometer, and hygrometer, the general results of their observations would be so much the more satisfactory; but one instrument of each kind is indispensable. In the former case, each observer will note the indications of his own instruments.

4thly. Care must therefore be taken to note down at the beginning, during, and at the close of the observations, the indications of the several instruments, together with the general state of the weather and the direction of the wind, if there be any, though it is most advisable to observe before and after wind.

5thly. The change of level of the water must be noted sometimes every minute; at others, every ten minutes, every half-hour, or every hour. The observations should be sometimes made at sunrise, three hours after his ascension, at noon, at three in the afternoon, and at sunset, as also after, if convenient, in order to see how far the hour exercises an influence on the phenomenon. It would likewise be well to observe if the moon has any influence, and, for this purpose, observations should be made at the new and full moons, and at the quadratures.

6thly. On an outline sketch plan of the lake must be marked the different stations, numbered or lettered, indicating the distance of each station from every other. This is necessary, in order that the observer may be assured whether the rise or fall observed simultaneously at two or more stations are distinct and independent, though simultaneous effects, or dependent and corresponding oscillations.

7thly. For each series of observations, a table, in the following form, should be arranged.

Observations of the Seiches of Lake ______________
made by ________________ *Date* ______________

Time of Day.		Station A.	Station B.	&c.	Remarks.
Hour.	Min.				
9	0	ft. in. li. R. or F.* 0 0 0	ft. in. li. R. or F. 0 0 0		
	10				
	20				
	&c.				

Moreover, in order that nothing may be omitted which can be supposed to exercise any influence, the topographical structure of the basin, and particularly the aspect, height, position, and nature of the hills in the immediate vicinity of the lake, if there be any; or, otherwise, their absence must be carefully noted.

It were needless to add, that the more numerous the observations the better; and the more that may be made simultaneously, the more satisfactory will be the result.

I will not presume so far to question the sagacity of the Society as to enumerate all the advantages that are likely to accrue from observations of the kind just stated; they will be, I doubt not, as evident to all as they are to myself, and it is from this conviction that I venture to call the attention of my colleagues to the subject.

Schutten, as may be seen in the "Mémoires de l'Académie des Sciences de Stockholm," for 1804, explains the irregular rise and fall of the Baltic on the same principle as De Saussure and Vaucher explain the seiches of the lake of Geneva. I hope to be one day enabled to add further observations in support of the general prevalence of the phenomenon.

I have lately written to a most eminent philosopher, the present boast of Sweden, begging of him to institute observations (similar to those here proposed) upon the great lakes of his country; I have also written to the United States, on the same subject; and circulars have been addressed, officially, to the engineer officers stationed at the several great lakes of Russia, as far as the Baikal, for the same purpose. If, as I trust, we shall by these means obtain a mass of well-authenticated information, we shall have one fact more to add to our knowledge of the earth, and one fact often leads to many. I sincerely hope the Royal Geographical Society will not consider the subject unworthy their notice.

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* R. or F. for *rise* or *fall*, as it may be. As all that is required is *relative* rise and fall, the height at which the water may be found on commencing the operation will always be 0. In the column of remarks will be consigned the indications of the barometer, &c.

IV.—*On the Communication between the Atlantic and Pacific Oceans, by way of the Lake of Nicaragua.* Communicated by Captain Phillips, R.N., F.R.G.S.

In the month of January, 1833, the Spanish merchants residing at Kingston, Jamaica, connected with central America, requested the senior naval officer at Port Royal to allow the ship of war that carried the mail to Chagres to proceed on to San Juan de Nicaragua, expecting that, if a regular monthly communication were established with San Juan de Nicaragua, as there is between Chagres and Port Royal, that the merchants of central America would gladly avail themselves of it to carry on a commercial intercourse direct with Jamaica, instead of by Omoa and Truxillo to Belize. Commodore Farquhar, acceding to their wishes, sent the Ariadne for that purpose. When at San Juan de Nicaragua, a merchant (with his two sons), from Costa Rica, was embarked, who had been for the last thirty years traversing Costa Rica and Guatemala, a dealer in mules, and in all the productions of the commerce of that country; and consequently quite capable, from the experience he had obtained, added to his natural shrewdness, of giving such information relative to the commercial productions of the towns, inhabitants, &c. of central America, as would serve to give some notion of the immense advantages likely to be obtained by establishing a direct communication between San Juan de Nicaragua and San Juan del Sul on the Pacific. This might, it appears, be easily effected by cutting a canal from the town of Nicaragua to the port of San Juan del Sul, and by establishing steam-boats on the lake and river of San Juan de Nicaragua.

Mr. Lloyd, formerly attached to the staff of Bolivar, has given, in the Philosophical Transactions for the year 1829, and in the first volume of the Geographical Society's Transactions, a most interesting description of the road proposed to be made from La Trinidad to Chorrera or Panama; which account was borne out in all its particulars by some Panamanian merchants of great respectability, who were embarked on board the Ariadne, at